DOCUMENT RESUME

ED 029 773 24 RE 001 854

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Identification and Remediation of Perceptual Handicaps in Learning to Read. Final Report.

Glen Cove School District, N.Y.
Spons Agency-Office of Education (DHEW), Washington, D.C. Bureau of Research.
Bureau No-BR-7-8015
Pub Date Apr 69
Contract-OEC-1-7-078015-2986
Note-17p.
EDRS Price MF-$0.25 HC-$0.95
Descriptors-Grade 2, Perception Tests, Perceptual Development, Reading Achievement, *Reading Diagnosis, Reading Improvement, *Reading Research, *Retarded Readers, *Visual Perception, *Word Recognition

Results of an investigation of the effects of perceptual training upon selected measures of reading achievement are reported. Subjects were 87 second-grade children of average intelligence who had evidenced reading difficulties as well as perceptual deficits. They were chosen from the Glen Cove, New York, school district on the basis of their performance on the following tests: the Lorge-Thorndike Intelligence Scale; the Wechsler Intelligence Scale for Children (WISC); the Stanford Reading Test, Word Recognition section; and the Frostig Developmental Test of Visual Perception. Subjects were divided into three matched groups: a group that received 25 minutes of perceptual training twice a week, a group that received traditional remediation for the same length of time, and a control group. An analysis of variance of the reading achievement scores showed no significant differences before treatment. A t-test revealed that the remedial reading group post-test scores were significantly higher (.05 level) than those of either the control group or the perceptual training group. An analysis of variance of the Frostig data showed no significant differences between the means of the three groups. No distinctive WISC subtest patterns for retarded readers were noted. References are included. (WB)

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FINAL REPORT

BR-7-8015
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Project No. 7-8015

Contract No. OEC-1-7-078015-2986

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Acknowledgment

The authors wish to express their gratitude and thanks to the many colleagues and friends who gave encouragement and support throughout the progress of this work. We are deeply indebted to our project consultant, Marcia Guttentag of Queens College, C. U. N. Y., New York for her help and suggestions, and to Everett and Marianne Williams of Columbia University, N. Y., who completed much of the statistical analysis. We also wish to thank the administrators and teachers of the Glen Cove Public School System, and especially Superintendent Albert R. Brinkman, and Curriculum Coordinator, I. L. Roy Stern, for their cooperation in making subjects for this experiment available. This paper owes much to Myrna Lewis, our project teacher, who had the day to day responsibility of training the children, and who contributed her skill and enthusiasm in all areas of data collection. Finally, we are deeply indebted to Dolores Winter and Sally Bodi for their thoughtful criticisms and comments, and to Mary Doherty for putting the manuscript in its final form.

Summary:

The original purpose of this study was to investigate the effects of perceptual training upon selected measures of reading achievement. The subjects were 87 second grade children, of average intelligence, who had evidenced reading difficulties in school as well as perceptual deficits. These subjects were chosen on the basis of their performance on the following tests: the Lorge-Thorndike Intelligence Scale, the Wechsler Intelligence Scale for Children, the Stanford Reading Test, Word Recognition section, and the Frostig Developmental Test of Visual Perception. On the basis of these scores the subjects were divided into three matched groups: 1) a group which received perceptual training for 25 minutes, twice a week, 2) a group which received the same amount of traditional remedial reading help, 3) a group which received no extra help.

The analysis of variance technique was applied to the reading achievement scores. There was no significant difference found among the means of these three groups before treatment. However, post-testing revealed a significant difference among the means of these groups. A t test revealed that the scores of the group which received remedial reading were significantly higher at the .05 level than either the perceptual training or the "no treatment" control group. Furthermore, an analysis of variance performed on the Frostig data indicated no significant difference in visual perceptual ability among the three groups after treatment. No distinctive patterns of WISC subtest profiles were revealed for retarded readers at this age level.

Introduction:

One of the major problems in education is the early identification and remediation of children with average intelligence who have serious difficulty in learning to read. During the past ten years, the literature has increasingly reflected the concern of many professional disciplines with the identification and education of these children. (1, 5, 6, 7, 8, 9, 10, 15, 16, 18, 19, 20, 21) When low intelligence has been ruled out, and there is no sign of physical impairment, children are often labeled "immature." De Hirsch (1957) gives a more precise description of this "immaturity:" "Maturation is largely a process of integration and differentiation. The child of six and older whose perceptual, motor, visuo-motor and conceptual performance is still relatively primitive, the child who has trouble with structuralization of behavioral patterns is the one who is liable to run into difficulties when he is exposed to reading, which requires the smooth interplay of many facets of behavior."

The crucial role of perceptual deficiencies in early reading disabilities is indicated in one estimate (19) that 95 out of 100 children who have reading disabilities also show patterns of perceptual defects. A recent study (4) which examined visual and auditory perception in relation to reading found significant differences between retarded and

average readers in the efficiency with which they utilized perceptual inputs. The most complete recent analysis of beginning reading research found that reading success in the primary grades is most significantly correlated with well-developed perceptual skills (6). The same analysis indicated that intelligence and language ability played a larger role in reading achievement in the middle grades. Therefore, early in the school career of children who have perceptual handicaps, intervention should be most appropriate.

If the consequences of perceptual deficiency are so serious in the primary grades, one may ask whether intervention is necessary with these children, or whether maturation alone will suffice, and if intervention is attempted, what type will be effective?

Research and theory have recently given some startling new answers to the question of the importance of experience and learning vs maturation, for the development of perceptual and cognitive skills. Earlier theories based on analogies to biological maturation and the instinctual behavior of animals, thought both perceptual and cognitive skills are innate, unfolding processes which accompany the biological growth of the child (14). Recent research has shown that the brain is an open system and the codes which organize perceptual and cognitive processes in the brain must be learned (13). Further, that unless they are learned early in development, irreparable damage may be done (3). The practice of perceptual enrichment of the environment of infants is only one of the consequences of this new body of research. The child who is perceptually immature may <u>not</u> develop differential perceptual skills by maturation alone.

Many of the skills required for school achievement are learned, and rely on perceptual ability. Waiting for a child to be "more ready" may therefore put him at a progressive disadvantage.

A previous attempt to determine relationships between perceptual training upon selected measures of reading achievement (Rosen, 1967) used 637 randomly selected first grade pupils. The experimental group received 15 hours training with the Frostig materials while 13 control classes added comparable time to the regular reading instructional program. Analysis of the data revealed significant differences between the treatment groups in most of the post perceptual capabilities, favoring the experimental group without concomitant effects on reading criterion measures. Rosen concluded that while the total score from the Frostig Developmental Test of Visual Perception appeared to have a strong predictive function regarding first grade reading, the training of visual perception subskills did not appear to have a significant effect on reading ability at the end of the first grade year.

The present study differs from the previous study in that: (a) only the children who had normal intelligence, a reading disability and a pattern of perceptual immaturities were used and (b) the reading criterion measure used was word recognition which concerns itself only with the perceptual skill of reading as differentiated from comprehension or reading for meaning. While word recognition or "word calling" is dependent primarily upon well organized intersensory connections, comprehension includes grasping main ideas, drawing conclusions and

forming opinions and is influenced more by language competency, and intelligence.

The problem of the present study is the identification of young children who are not reading well and who have average conceptual ability associated with perceptual handicaps. The effectiveness of perceptual remedial treatment, as compared with traditional reading readiness training, in improving word recognition skills, was the subject of this investigation. On the assumption that visual perceptual ability is learned, rather than innate, and that, as such, can be taught, it is hypothesized that children who receive specific training in visual perception will show significantly higher visual perceptual scores at the completion of training than children with similar deficits who do not receive this training. It is further hypothesized that visual perceptual ability is essential to early reading success and that children with deficits in this area who received specific training in visual perception will achieve higher word recognition scores at the termination of training than similar groups who receive traditional remedial reading or no treatment.

Methods:

The study consisted of four phases.

Phase I. Screening of subjects for the experimental and control groups. All second grade children in the Glen Cove Schools constituted the population from which the sample was drawn. All second grade children routinely receive the Stanford Achievement Test during September of their second grade year. The initial screening for reading skill was made on the basis of scores on the word recognition section. All children who scored below expectancy were subjected to further investigation to determine 1) whether they were of at least average conceptual ability and 2) whether they showed perceptual handicaps.

In order to screen out children who are below average in conceptual ability, Lorge-Thorndike test scores were used. Children scoring below 1 S.D. from the mean of the test (of those with below mean scores on the Reading section of the Stanford Achievement Test) were excluded from the subjects in the study, so that all subjects in the study were of at least average conceptual ability. Those children with poor reading skills who had average conceptual ability were given the Frostig Test of Visual Perception (9). This test establishes a child's level of performance in each of five areas of visual perception. The test provides age cut-off scores in visual perception. All children in the previously selected population, who score one year or more below age level in any or a combination of the areas of visual perception, were included in the experimental and control group population. Subjects for the study were therefore second grade children of below average reading skill who showed at least average conceptual ability but were below average in visual perceptual skills.

Phase II. Following group testing, each subject selected for the study was seen for an individual testing session. The purpose of the individual testing was to determine whether it would be possible to

differentiate pupils with reading difficulties according to subtest patterns on the Wechsler Intelligence Scale for Children. Those children who met the following criteria were placed in either an experimental or control group.

1. A WISC verbal score of 90 or above
2. Word recognition score 6 months below expectancy
3. Frostig score, one year below expectancy

Those subjects (87) finally selected for the study were children with normal or corrected vision and normal hearing, as judged from school medical records. They were drawn from a suburban elementary school for intellectually normal children. They were all second graders, chronological age ranged from $6\frac{1}{2}$ to $8\frac{1}{2}$. The population of the school was predominantly in the middle class but there are children from lower social economic groups in attendance and they were included in the study.

Phase III. Experimental intervention. All subjects who were selected for the experiment were randomly assigned to either experimental or control groups. There were one experimental and two control groups. The treatment extended for twenty weeks for 25 minutes twice a week. The experimental group received the following treatment:

Group I (Perceptual Training)

1) All subjects in the experimental group left their regular classrooms and proceeded, as a group, into a different room with a special teacher for 25 minutes twice weekly. This teacher provided instruction in the following areas: visual perception (similarities and discrimination), motor development, learning to listen, learning to look, visual tracking, and visual memory. The materials used in this instruction were primarily the Frostig Program for the Development of Visual Perception (9), as well as some teacher - developed materials. The special teacher who worked with children was the same for all groups and was specially trained in the use of perceptual materials.

Group II (Control: Remedial Reading)

2) These children left their classrooms for a 25-minute period twice a week. This Control Group received a traditional remedial reading course of instruction, which stressed the more linguistic aspects of reading skills such as phonetics, word attack skills, word analysis, and motivation for reading by use of familiar words, etc. Instruction was given by the same teacher as Group I.

Group III (Control: No treatment)

3) This group of children remained in their regular classroom throughout the day. This control group permitted the comparison of the effects of maturation alone with the two forms of intervention.

Phase IV. Post-testing. At the end of the experimental period, all subjects in experimental and control groups received the next level of the Stanford Reading Achievement Test. Each subject was also given the

Gates Primary Reading Test (10). These are tests designed to check on improvement in reading skills following the treatment. Improvement in perceptual skills was measured by administration of the Frostig Test. The statistical tool utilized in the analysis of the data was a 2 by 3 analysis of variance (repeated measures model) with "2" representing pre and post scores and "3" the perceptual training, remedial reading and control groups.

Results and findings:

To demonstrate the equivalence of treatment groups prior to training, t tests were run on the three variables, intelligence, perceptual ability, and reading. Comparability of the groups on all three variables was demonstrated by the fact that there were no significant differences in the means of the groups under consideration on any of the test scores. A summary of the data demonstrating the equivalence of treatment groups prior to treatment may be found in Table I below.

Table I

Means and Standard Deviations Between Treatment Groups for I.Q., P.Q., and Reading Achievement Prior to Treatment

Groups	N	Mean I.Q.	SD	N	Mean P.Q.	SD	N	Mean Read A.	SD
I Perceptual Training	30	103.4	8.87	28	93.4	10	29	11.8	3.0
II Remedial Reading	27	101.0	7.89	29	94.5	8	29	13.3	3.1
III Control	27	100.2	9.86	27	94.8	10	27	12.1	3.6

The first hypothesis that children who receive specific training in visual perceptual tasks will show significantly higher scores on the Frostig Test of Visual Perception at the completion of training than children with similar deficits who do not receive this training was not supported by the results (see Table II below).

Table II

Means of Total Frostig Scores Pre and Post Training

Groups	N (Pre)	Mean	N (Post)	Mean
I Perceptual Training	27	47.000	29	50.000
II Remedial Reading	29	47.517	29	47.552
III Control	27	47.778	28	47.786

Analysis of Variance

Source	Sum of Squares	D.F.	Mean Sq.	F
Col.(Groups)	28.375	2.	14.187	0.762
Row (Pre & Post)	43.409	1.	43.409	2.332
R x C	82.971	2.	41.486	2.229
WC	3033.914	163.	18.613	

Analysis of variance (repeated measures model) where "2" is pre and post and "3" is Perceptual Training, Remedial Reading and Control Groups.

The F value of .762 for the main treatment effect is not significant.

The mean visual perception scores were ordered as anticipated with regard to levels of improvement but the treatment effect was not strong enough to cause a significant difference between the groups.

The second hypothesis regarding the effect of visual perceptual training on word recognition skills was also not supported. The mean word recognition scores for the perceptual training group was 23.8 (N =28), for the remedial reading group 27.2 (N = 29), and for the control group 23.7 (N = 28). The data for the three groups under consideration will be found in Table III below.

Table III

Means of Stanford I Word Recognition Scores Pre and Post Training

Groups	N (Pre)	Mean	N (Post)	Mean
I Perceptual Training	29	11.379	28	23.821
II Remedial Reading	29	13.345	29	27.276
III Control	27	12.148	28	23.679

Analysis of Variance

Source	Sum of Squares	D.F.	Mean Sq.	F
Col.(Groups)	252.391	2.	126.195	5.254**
Row (Pre & Post)	6779.547	1.	6779.547	282.239
R x C	41.641	2.	20.820	.867
WC	3938.822	164.	24.017	

** $p > .01$

Analysis of variance (repeated measures model) where "2" is pre and post and "3" is Perceptual Training, Remedial Reading and Control Groups.

The F ratio of 5.254 is greater than the .01 level and is therefore significant, indicating a main treatment effect on word recognition skills.

Several t tests were run between the reading achievement scores of the groups to discover which groups were significantly different from the others. A t test run between the word recognition scores of the remedial reading and perceptual training groups yielded a t ratio of 2.17 which was significant at the .05 level, showing that the word recognition scores of the group which received the remedial reading were significantly higher than the word recognition scores of either of the other two groups. The difference between the mean word recognition scores for the perceptual training group and the no treatment control group was not statistically significant.

Our findings are in agreement with Silverberg (1968) who was unable to differentiate pupils with reading difficulties according to subtest patterns on the WISC. A summary of the subtest scaled scores of the 144 children tested for this study is found in Table IV below.

Table IV

Mean Scores on WISC

	N	Mean	SD
Information	144	9.78	2.88
Comprehension	144	9.40	2.62
Arithmetic	144	10.12	2.51
Similarities	144	9.99	2.85
Vocabulary	144	9.86	3.14
Digit Span	135	9.84	2.62
Picture Completion	143	10.34	2.77
Picture Arrangement	143	10.69	3.04
Block Design	144	10.19	2.30
Object Assembly	144	9.79	2.76
Digit Symbol	143	11.41	2.77
Total I.Q.	143	101.21	10.70
Verbal I.Q.	144	99.38	11.84
Performance I.Q.	143	102.97	11.48

Conclusions:

The finding that the group of children in this study who received visual perceptual training did not improve in this area in a significant manner over those children who did not receive such training is difficult to interpret. This finding is contrary to Rosen's (18) insofar as his first grade children, who received less training than the subjects in this study, improved in perceptual skills, as measured by the Frostig, to a significant degree. The finding of the present study may be an example of the critical-period effect in operation. A highly tentative conclusion may be that children have a critical period for the formation of visual perception skills and that during that period a relatively small amount of effort produces major and lasting effects. However, if that period passes without the development of such skills, the ability of these children to learn and respond may be drastically reduced. Bloom (2) surveyed and analyzed hundreds of longitudinal studies of human growth in an effort to determine when and how individual characteristics develop. He concluded that the environment will have its greatest effect on a characteristic during the period of the most rapid normal development, while its effects will approach zero in the period of no normal change. Developmental data on visual perceptual skill have indicated that the most rapid and significant period for the emergence of this skill occurs between the age of four and seven. Since the population sample of this study was older than the sample used by Rosen it may well be that the children were being trained late in the critical period. The population of this study differed in another important variable, namely initial perceptual status. Rosen used an unselected sample of all first grade children while one of the selection criteria of this study was that the subjects evidence signs of perceptual immaturities. Predictions generated by the work of Frostig (9) were not substantiated. That is, no significant differences were found in the visual perceptual status of disabled readers as a function of specific training in this area. Also, as opposed to matched controls who did not receive such training, children trained in visual perceptual skills did not show a greater increase in word recognition ability as measured in this study.

A number of factors may have contributed to the lack of support for the experimental predictions of this study. One of the most important would seem to be the high degree of selectivity involved in obtaining the experimental sample, since the 86 subjects used had demonstrated reading deficits were older, and in general performed more poorly in both perceptual and reading areas than the sample used in other studies.

A second problem to consider is the arbitrarily set retesting date at the end of the term, immediately after the completion of the training. This date may have been too early to detect differential changes in word recognition skills associated with changes in the perceptual status.

Further researchers in this area should probably obtain empirical determinations of the time limits for retesting by pilot studies.

Another difficulty involving the retesting of subjects was that all groups demonstrated significant improvement in perceptual skills over time. It is impossible to determine what proportion of this increase in visual perceptual skills was a function of actual perceptual improvement and what proportion was due to the effects of practice only. The previous research on visual perception has not concerned itself with practice effects on Frostig performance. Therefore, it seems advisable for any future study of visual perceptual performance over time to include a group of subjects who are tested at Time 2 only to give a measure of improvement associated with time.

The low overall correlation between visual perception and reading ability leads one to conclude that although reading disability may be characterized by visual perceptual immaturity and hence a developmental lag, this factor cannot account for the total number of children showing reading deficit. Demographic variables such as age, socioeconomic status, and birth order should be investigated, as well as other specific personality dimensions.

The major purpose of this study was to investigate the effects of a specifically defined program of visual perception training on word recognition skills of second grade disabled readers of normal intelligence. The conclusions and inferences which are made are limited by the design of the study, which include among other things, the population from which the sample was drawn, the perceptual training program as defined in this study, and the testing in word recognition skills immediately after the conclusion of the perceptual training program. Thus the group that received remedial reading training was at some slight advantage since they were being tested on a more training-related task. Whether the perceptual training group will make dramatic gains in the next year as a result of increased ability to benefit from reading instruction is something that should be investigated.

Within the various limitations of this study, the findings can be given this interpretation. Perceptual training, as defined and described in this report, did not seem to influence word recognition skills for the second grade disabled readers, as measured by the instrument utilized in this study. The group which received the remedial reading instruction was significantly superior post treatment to the other two groups in word recognition skills. It might appear that the additional time devoted to regular reading instruction in the school system's curriculum might be considered more important for the pupils in this population, in this one particular reading outcome (word recognition), than the time devoted to the specific types of perceptual training activities as defined in this investigation.

It is obvious that considerable room exists for further experimental study in this area. Future investigators should systematically vary both quantitatively and qualitatively the treatment for differently diagnosed youngsters in terms of age, level of perceptual impairment, and specific area of perceptual deficit. It would seem necessary to obtain information from research determining first what the roles of specific perceptual capabilities are in reading growth and development,

and the influence of training various abilities, before consideration is given to the wholesale modification of curriculum.

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